

82, 84, 86 and 88 and the bit centerline or axis B. The PDC cutter location points are designated with an X. The mold forming bit pattern 80 of the present invention is machined from a suitable material such as steel, aluminum, wood or graphite.

Generally, a bit pattern having a faceted profile in accordance with the present invention can be constructed by modifying an existing conventional curved profile bit pattern to include the desired facets. More particularly, this can be accomplished by scribing a cutter location point on the conventional curved pattern surface, rotating the pattern to the angle of the desired flat surface or facet, centering over the scribed cutter location, replacing the scribing tool with a mill tool, touching off of the pattern surface to determine zero depth, and plunging the mill tool to about 0.095 of an inch and running it out in all directions. In such a process, it may be necessary to cut the inner flat surfaces or facets before the outer flat surfaces to prevent removal of location points prior to machining.

With reference again to FIGS. 2 and 3 of the drawings, the matrix body drag bit 30 of the present invention is made by forming the mold 60 having a faceted inner surface 62 by either machining graphite to form a hard mold or by first machining a bit pattern to have a faceted profile (FIGS. 5A-5D) and then pressing the pattern into a settable mud to form a soft mold, adhering the cores 64 to the inner surface 62 of the mold 60, placing a shaped mandrel or blank along the centerline of the bit in order to leave open the drilling fluid central passage 52 and ports 54, placing the head blank 34 in the mold 60 with the head blank 34 spaced from the inner surface 62 of the mold 60 and surrounding the fluid passage forming mandrel, filing the spaces in and around the head blank 34 with a powdered hard metal skeleton, infiltrating the hard powdered metal with an alloy binder to form the matrix body 32 on the head blank 34, removing the matrix body from the mold and removing all of the plugs 64 and the fluid passage mandrel from the matrix body 32, welding the top sub 36 to the head blank 34, inserting the nozzles 56 into the ports 54, and finally securing the PDC cutters 40 in the sockets 42 by brazing.

Thus, it will be appreciated that as a result of the present invention, a highly effective drag bit, mold, pattern and method is provided by which the principal object and others are completely fulfilled. It is contemplated and will be apparent to those skilled in the art from the foregoing description and accompanying drawing illustrations that variations and/or modifications of the disclosed embodiment may be made without departure from the invention. For example, although only a single PDC cutter is shown in each facet of the faceted wings of the drag bits 10 and 30, it is contemplated that a plurality of cutters may be located on a single facet (especially in the facets adjacent the gage). Accordingly, it is expressly intended that the foregoing description and accompanying drawings are illustrative of a preferred embodiment only, not limiting, and that the true spirit and scope of the present invention be determined by reference to the appended claims.

What is claimed is:

1. In a drill bit having a plurality of cutting elements distributed over the profile of the bit, the improvement comprising:

a facet in the bit profile adjacent each of said cutting elements located in an otherwise curved area of the bit profile, and wherein a number of said cutting

elements are mounted in raised wings in said bit profile and said wings are faceted.

2. The drill bit of claim 1, wherein said drill bit is a full bore matrix body drag bit.

3. In a drill bit having a body defining a cutting face with openings extending into said body for supporting a cutting element in each opening, the improvement comprising:

a plurality of facets in said body, each of said faces surrounding a corresponding opening for receiving a cutting element, wherein each of said facets is oriented perpendicular to the longitudinal axis of its corresponding opening, and wherein said facets and openings are located in raised cutter supporting wings in said bit body.

4. The drill bit of claim 3, wherein said drill bit is a full bore matrix body drag bit.

5. In a method of producing a matrix body bit including the steps of forming a pattern, placing the pattern in a settable mud, removing the pattern, hardening the mud to form a bit mold, attaching a plurality of cores to the mold surface to create openings in the resultant matrix bit body for mounting cutter elements, forming a matrix bit body in said mold using an infiltration process, and mounting cutter elements in the openings formed by said cores, the improvement comprising the step of:

forming a plurality of small flat surfaces in the exterior of said pattern with each of said flat surfaces corresponding to the location whereat at least one of said cores is to be attached to said mold.

6. The method of claim 5, wherein each of said small flat surfaces is perpendicular to the longitudinal axis of the corresponding core.

7. The method of claim 6, wherein said cutter elements are located in raised wings in said bit body and said small flat surfaces lead to the formation of facets in said wings.

8. A pattern formed in accordance with the method of claim 5.

9. A mold formed in accordance with the method of claim 5.

10. A matrix bit formed in accordance with the method of claim 5.

11. A method of forming a plurality of small surfaces in a bit pattern comprising the steps of:

scribing a cutter location point on the pattern surface, rotating the pattern to the angle of the flat surface, centering over the scribed cutter location, replacing the scribing tool with a mill tool, touching off of the pattern surface to determine zero depth, and

plunging the mill tool to about 0.095 of an inch and running it out in all directions.

12. The method of claim 11, wherein inner flat surfaces are cut before outer flat surfaces to prevent removal of location points prior to machining.

13. In a pattern for forming a mold for a matrix body bit having one or more raised wings for supporting a plurality of cutter elements, the improvement comprising:

a plurality of facets in said wings, each of said facets corresponding to the location of at least one of said cutter elements.

14. The pattern of claim 13, wherein said cutter elements are stud mounted and each of said facets is perpendicular to the longitudinal axis of the stud of the corresponding cutter element.